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AN EXPERIMENTAL INQUIRY INTO THE CONSTITUENT PRINCIPLES OF THE SULPHUREOUS WATER AT *NOTTINGTON* NEAR *WEYMOUTH*:

TOGETHER WITH

OBSERVATIONS relative to its APPLICATION in the CURE of DISEASES.

BY

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> *Nec te poeniteat duros ſubiiſſe labores,*
> *Aut operi inſuetas attenuaſſe manus.*
>
> *TIBULLUS.*

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INTRODUCTION.

DURING my attendance at Weymouth laſt Summer, I was induced to make, by the uſe of a few chemical teſts, ſome trials on NOTTINGTON WATER, *without any view whatever to their publication. But as the reſult of theſe experiments turned out different from what I had reaſon to expect, having read the accounts given by different Writers of its Mineral Contents, I reſolved in the Spring following to proſecute my inquiries ſtill further, with the hope of inveſtigating more accurately the nature of the ſeveral ſubſtances contained in it; and, with the advice of ſome friends, to communicate the reſult of them to the public. In doing this, I have not confined myſelf to a tedious detail of experiments,*

experiments, unintereſting to the generality of readers, and calculated only for the peruſal of thoſe who have acquired ſome knowledge in the Science of Chemiſtry; but for the uſe of ſuch invalids as may be led to employ the Water medicinally, have ſubjoined an account of its probable virtues in particular diſeaſes, with remarks interſperſed on the moſt eligible mode of its application.

It would have been ſcarcely neceſſary to mention here how particularly ſerviceable is a Complete Examination of a Mineral Water, in the way of Chemical Analyſis, as a guide by which we are directed to the moſt judicious and ſucceſsful application of it for the purpoſes of Medicine, if a late Writer on the Nottington Water, ſpeaking of ſuch reſearches, had not detracted from them much of that importance which now in general is conſidered as their due. Though he ſeems apprized that great diſcoveries and uſeful improvements are continually made in analyſing Mineral Waters; yet, perhaps, it would be doing him no injuſtice, but even acting *with commendable lenity, to imagine that he was not fully aware of all the valuable diſcoveries, reſpecting the compoſition of theſe fluids, made by Modern Chemiſts; for, otherwiſe, he ſurely could not have treated, with ſo much indifference and contempt, the very material aſſiſtance towards aſcertaining their Medicinal Properties, which Chemical Reſearches, when rightly performed, are capable of affording. Indeed, ſo conſiderable is the light which has been diffuſed on this important part of Nature's works, by the ſucceſſive diſcovery, and diligent examination of their nature and properties, of the ſeveral aëriform fluids, viz. cretaceous acid, phlogiſticated and hepatic air, that the impenetrable veil lately thrown over it is now happily removed; and hence our ideas concerning thoſe popular remedies are become proportionably more determinate, ſatisfactory, and clear.*

Among other conſiderable advantages to be derived from the Analyſis of Waters, the celebrated BERGMAN *has very judiciouſly obſerved—" If*

" long experience has ſhewn the efficacy of the " water in a certain fountain, and if at the ſame " time the contents of that water be known, we " are enabled to anticipate the experience of years, " and inſtantly to form a judgment concerning the " virtue of other waters, which exactly reſemble " in their contents the water whoſe properties " are already eſtabliſhed"(a). *Thus, with regard to Nottington Water, (the ſubject of the few following pages) without even the leaſt perſonal experience of its particular effects, one might be able, from a knowledge of the heterogeneous matters contained in it, joined to that of any other ſimilar water, whoſe mineral contents and medicinal properties have been ſufficiently inveſtigated, to fix its virtues, and predetermine its operation with little fear or probability of miſtake.*

Of what importance and advantage to the community, the Analyſis of Mineral Waters has long been eſteemed by men of learning and celebrity,

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(a) See Phyſical and Chemical Eſſays, vol. I. p. 112.

we may ſufficiently judge from the number that have directed their labours this way, and the uniform tenor of their writings in recommending it to others: And yet the early labourers, in this field for inveſtigation, were highly ſenſible of their inſufficiency to explore its various products, with ample ſatisfaction, alike to others and themſelves. Under this conſideration, together with the preſent improved ſtate of our knowledge relative to the preciſe nature of theſe fluids, the propriety of proſecuting ſuch inquiries further, muſt appear exceedingly obvious. It is true, that on moſt of the medicated waters of this country, that of Nottington not excepted, ſeveral trials have been inſtituted with a view to diſcover their reſpective contents; but theſe laudable attempts were chiefly made prior to the late noble diſcovery of the different gaſes already mentioned, which, as it is now well known, enter very copiouſly into the compoſition of particular waters, highly celebrated for their healing virtues, and on which their *great uſefulneſs and activity more eſpecially depend. That the greater part, therefore, of the analyſis of waters, with which we are as yet furniſhed, is inaccurate or incomplete, there is no ſmall ground for preſuming; whence it may deſerve to be earneſtly recommended to ſuch as poſſeſs ſufficient knowledge and opportunities for the purpoſe, to enter on a thorough inveſtigation, in order to confirm or diſprove the reſpective accounts of the ſeveral mineral waters which writers of a diſtant period, and others who have only copied after them, have given us.*

Of the celebrated Waters of Bath, Cheltenham, and Harrogate, judicious accounts have been lately communicated to the public by men of diſtinguiſhed learning and abilities. And it is to be hoped, that the laudable example of theſe able inquirers after truth, will be ſtudiouſly followed by others, in aſcertaining by ſuitable experiments the genuine nature and properties of other medicated waters; for it is *highly probable that of theſe, though not of equal renown, ſome few at leaſt might, if judiciouſly employed, be found no leſs efficacious in the cure of certain diſeaſes. Thus a real and manifeſt ſervice would accrue to the public; and, with regard to thoſe various productions of Nature ſeparately, our knowledge would be rendered more firm and exact, which, amidſt the many valuable improvements continually making in various departments of Science, could not but be approved by all enlightened and impartial obſervers.*

WEYMOUTH, Aug. 30, 1792.

OF
NOTTINGTON WATER.

PART I.

Of the Situation, ſenſible Qualities, &c.

ABOUT the diſtance of two miles from WEYMOUTH, between which place and DORCHESTER, a little to the weſtward of the turnpike road, lies NOTTINGTON, a ſmall hamlet, in which there is a Mineral Spring. This ſpring, ſurrounded by a ſtone edifice, is ſituate about three or four yards from a riſing ground to the ſouth; on the oppoſite ſide of it, at a ſhort diſtance, runs the river *Wey*. Within the ſpace of ten or twelve yards from the well there are different places on the weſt, which manifeſtly exhibit the preſence of ſulphureous matter; eſpecially when the ſeaſon is wet, ſo that the water collects above the ſurface of the ground. Some of the contiguous ſtanding water by the river appears to be ſlightly impregnated with iron, but betrays no ſigns of a ſulphureous quality. On the inſide of the well may be clearly diſtinguiſhed a circular whitiſh border, which marks the height to which the water commonly riſes; and along the channel by which the water is diſcharged a copious yellowiſh white depoſition may be ſeen adhering to the blades of graſs and ſtones over which it flows. Of theſe, ſome are tinged with a blackiſh colour, reſembling æthiops. The white yellowiſh matter, when collected and gently dried, being laid on a red-hot iron, burns with the blue flame and ſmell of ſulphur.

Nottington Water when taken freſh from the well appears, in general, as clear and tranſparent as pure fountain water; emits a ſtrong ſulphureous odour, reſembling that of the ſcourings of a gun; and has a taſte which may be not unfitly compared to that of an egg boiled hard. By expoſure to the atmoſphere, in an open glaſs veſſel, it gradually becomes of a light pearl colour; loſes its fetor; and depoſits a whitiſh ſediment.—Though it commonly poſſeſſes great clearneſs and tranſparency, yet theſe qualities are ſometimes conſiderably injured, and then it appears of a light opal or milky hue.

Whether this water has ever been known to freeze, it is impoſſible rightly to determine, ſince no one that I could learn recollects any inſtance of the kind. In the month of April, when the weather was exceedingly warm, and the thermometer ſtood at 64°. in the ſhade, the temperature of the water in the well was 49°. while the adjoining river made the mercury in the thermometer riſe to 57°. About the middle of July it was raiſed to 52°. the thermometer ſtanding at 66°. in the ſhade, and the water in the river at 63°.

With the help of a ſmall pair of ſcales of tolerable nicety, I carefully weighed an equal quantity of this and of diſtilled water, having previouſly brought them to the ſame temperature; the ſpecific gravity of the former I found to be to that of the latter as 1,00048 to 1,00000.

Appearances of NOTTINGTON WATER *with Precipitants* (a).

Iron, &c. With tincture of galls, or with ferruginous pruſſiate of potaſh, Nottington Water exhibits no ſigns of any thing metallic.

Carbonic acid Gas, or cretaceous Acid. Tincture of turnſole receives no change of colour;

(a) That the learned reader, from the ſubſequent facts, may draw his concluſions, with the leſs difficulty, concerning the different impregnations of this Water, I have annexed to each of the mineral ſubſtances likely to be contained in it, the appropriate experiments under one head, by which it may be readily diſcovered, whether any ſuch particular ſubſtance be preſent or not; and from which alſo its ſtate of combination may be in ſome meaſure determined. The only objection which can with any reaſon be urged againſt the uſe of this method is the neceſſity of repeating experiments with teſts that have been before mentioned. But the number of inſtances is ſmall in which this repetition becomes abſolutely neceſſary; and, in other reſpects, that this method of arranging the experiments, partly for the reaſon already aſſigned, has a conſiderable advantage over that of detailing them ſeparately, according to the ſucceſſive admixture of the ſeveral precipitants employed, will, I truſt, prove ſufficiently obvious without being further inſiſted on.

nor does the ſulphuric or vitriolic acid occaſion any immediate effervеſcence, but in a ſhort time it produces an extrication of air bubbles, which are ſeen attached to the bottom and ſides of the glaſs.

Sulphurated hydrogen Gas, or hepatic Air. The fuming nitrous acid ſoon occaſions a milky cloudineſs, at the ſame time diminiſhing the fetid odour; and at the end of twenty-four hours a ſubtile white powder is depoſited at the bottom of the glaſs. A few grains of white arſenic immerſed gradually grow yellow, and at length acquire the nature of orpiment.

Alkaline or earthy Sulphure, or Hepar Sulphuris. The ſulphuric acid no way injures the clearneſs or tranſparency of the water; nor does it in the leaſt reſtore the ſulphureous ſmell after it is once loſt by expoſure to the air.

Fixed Alkali. Syrup of violets is quickly rendered of a light or ſea green colour, which continues for many hours unchanged (b), and paper tinged red with an infuſion of Brazil wood is changed to a purple. Theſe effects become more perceivable, after the water has undergone a ſuitable evaporation; and now paper made yellow by turmeric, which before ſuffers no alteration, is turned ſomewhat, though ſlightly, brown.

(b) It has been obſerved by M. Neumann and the Count de Saluces, that ſyrup of violets rendered of a green colour by alkaline liquors

Lime; or calcareous Earth. The oxalic or ſaccharine acid produces conſiderable turbidneſs, and by degrees a copious whitiſh precipitate falls to the bottom and on the ſides of a glaſs, which does not diſſolve by

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quickly paſſes from thence to a yellow; but when thus changed by neutral ſalts, it ſuffers no further alteration. But with regard to this reagent it may be proper to remark, what I have repeatedly experienced, that it is not made green by any of the neutral ſalts, unleſs there be preſent a ſuperabundant portion of alkali; in which caſe the change continues permanent. The neutral ſalts then do not poſſeſs the property of converting ſyrup of violets to a green, without the preſence of ſome additional alkali; yet, when once the green colour is produced, they ſerve to render it permanent, whereas that occaſioned by an alkali alone, in the ſpace of three or four hours, ſenſibly paſſes to a yellow.

The property of changing ſyrup of violets to a green is not peculiar to alkalis only; for the earths, lime, magneſia, &c. readily produce the ſame effect; and it may be ſuppoſed that this property remains uninjured in any of the terreſtrial ſalts with an over proportion of its earthy baſis. Alum, as M. Baumé firſt diſcovered, is capable of combining with its earthy baſis, argillaceous earth, in exceſs; and thus it acquires new characters, among which that of converting ſyrup of violets to a green is enumerated.

the addition of any ſuperabundant quantity of the acid (c). The ſame is alſo obſervable after boiling, though an earthy matter is thereby depoſited, which on examination evidently partakes of a calcareous nature.

Magneſia. Cauſtic volatile alkali, or ammonia, in a ſhort time occaſions whitiſh flocculi, which gradually ſubſide to the bottom of the glaſs; and lime water immediately cauſes a milky turbidneſs. The copious precipitate which the latter of theſe ſubſtances produces, readily diſſolves in diſtilled vinegar. Theſe effects are likewiſe in a ſlight degree obſervable, after the water has been ſomewhat concentrated by evaporation (d).

(c) Bergman obſerves, that the acid of ſugar poſſeſſes a ſtronger attraction for magneſia than the ſulphuric, nitric, or muriatic acids; and that the compound ariſing from it with that earth, in the form of a white powder, is not ſoluble either in water or ſpirit of wine, unleſs the acid be ſuperabundant. Saccharated lime, notwithſtanding any ſuch means, it is well known, remains perfectly inſoluble.

(d) From the experiments here related, it might perhaps be inferred that this water contains a magneſian or an aluminous ſalt. For this reaſon it may not be improper to obſerve, that though the volatile alkali made uſe of, did not efferveſce with acids, or render lime water milky, yet from the known difficulty of preſerving it pure, there is room to doubt whether it was ſo completely deaërated as to loſe the property of decompoſing calcareous ſalts by a double elective attraction. That the Nottington water contains ſulphate of lime and aërated magneſia, will afterwards be ſhewn. It is therefore no way difficult, on the ſuppoſition here advanced, to explain how the above appearances were occaſioned.

Alumine, or argillaceous Earth. Of the earthy matter which is depoſited by a long evaporation, a ſmall portion of a whitiſh colour, remains undiſſolved after the affuſion of diſtilled vinegar.

Sulphuric or vitriolic Acid. Muriate of barytes produces a ſlight cloudineſs, and at the end of twenty-four hours a ſmall portion of a whitiſh coloured matter is adherent to the bottom and ſides of the glaſs. Acetite of lead immediately occaſions conſiderable turbidneſs, and a dark brown coloured precipitate quickly enſues; of which a ſmall part reſiſts the action of diſtilled vinegar.

Muriatic Acid. Nitrate of ſilver inſtantly produces a conſiderable dark cloudineſs, and by degrees a copious browniſh curd-like matter ſubſides to the bottom of the glaſs. The ſame effect is alſo obſervable, excepting a difference of colour, in a glaſs of the water, to which a few drops of nitrous acid have been previouſly added. With nitrate of mercury the water is immediately made turbid, the upper part of which appears of an exceedingly dark brown colour, and the lower of an obſcure yellowiſh white, containing a large portion of curd-like ſediment of a ſimilar hue.

Principles collected by Evaporation.

In order to aſcertain the proportion of the fixed principles with which the Nottington water is impregnated, two gallons of it, wine meaſure, were carefully evaporated to dryneſs in a *balneum mariæ*; the quantity of reſiduum obtained, which was of a whitiſh brown colour, amounted to 63 grains. To this reſiduum was firſt added a ſmall portion of rectified ſpirit, and the whole well ſhaken together, with a view to ſeparate any deliqueſcent ſalt it might contain; after ſtanding ſome hours the liquor was filtered, and by a gentle heat evaporated to dryneſs. A ſaline ſubſtance, weighing upwards of two grains, was thus procured; conſiſting of muriatic acid, as evidently appeared by a grey fume becoming viſible on the affuſion of concentrated ſulphuric acid, and of an alkali, as a watery ſolution of it did not grow turbid with the addition of a few drops of *aqua kali.* To determine the nature of the alkali no attempt was made, the quantity of it being much too inconſiderable for any adequate trial; the want of this, however, is in a great meaſure ſupplied by the ſubſequent experiments, which clearly denote it to be of the vegetable kind.

To the reſidue were next added eight times its quantity of cold diſtilled water; the mixture was ſhaken, and after remaining ſome time, it was filtered. The clear liquor which ſhewed manifeſt ſigns of a diſengaged alkali, being evaporated to dryneſs, left a ſubſtance twenty-four grains in weight. In order to diſcover the ſpecies of this diſengaged alkali, and to ſeparate it from the neutral ſalt with which it was combined, the following method was employed:—On the ſubſtance procured from the aqueous ſolution juſt mentioned, I poured a ſmall portion of diſtilled vinegar, which diſſolved the whole; to this, after carefully reducing it to dryneſs, a little rectified ſpirit was added, becauſe, as M. Gioanetti has remarked, it diſſolves an acetated alkali, without acting on marine ſalt. After ſeparating the clear ſpirituous part from the inſoluble, and cauſing it to evaporate, I collected a dry browniſh ſubſtance, which, expoſed to the air, quickly attracted moiſture, and at length became fluid. Hence we may conclude the alkali to be of the vegetable kind; for, as M. De Morveau has obſerved, diſtilled vinegar forms, with the foſſile alkali, a foliated cryſtallizable ſalt, but with the vegetable a ſalt ſtrongly deliqueſcent.

Having determined to what ſpecies the diſengaged alkali belonged, it next became requiſite to examine the nature of the neutral ſalt with which it had been united. For this purpoſe I ſubjected a little of it to the action of concentrated ſulphuric acid; immediately a grey fume aroſe, which was rendered more viſible by applying to the mouth of the phial a piece of paper moiſtened with water. Over the phial I likewiſe held paper impregnated with volatile alkali, but the colour of the fume continued unchanged. Theſe experiments then ſhew the acid to be of the muriatic kind. To the remainder of the neutral ſalt, diſſolved in a little diſtilled water, was added a ſmall portion of tartareous acid that the nature of the alkali alſo might be equally aſcertained. After ſtanding ſome time, a whitiſh precipitate enſued; which affords a very ſufficient proof that it was the vegetable alkali with which the marine acid was united; for had the foſſile alkali only been preſent, no decompoſition would have taken place, becauſe it poſſeſſes leſs attraction for the tartareous acid than for the marine (e).

The reſiduum, which proved inſoluble in pure cold water, was boiled for a quarter of an hour, in about five hundred times its weight of diſtilled water, and the liquor afterwards filtered. To the filtrated ſolution I added a portion of *aqua kali*, which quickly produced conſiderable turbidneſs, and a white precipitate enſued. This collected by filtration amounted to ſomething more than three grains; which, one may reaſonably ſuppoſe, to have conſiſted of near two parts of pure lime, to one of carbonic acid, ſince, according to the obſervation of Bergman, the carbonic acid gas, expelled from carbonate of lime in burning, is equal in weight to about 0,34 of the crude maſs (f). The quantity of ſulphate of lime, therefore, diſſolved by the boiling water, we may conclude to have been about eight grains, it having been eſtimated that of ſelenite not quite a third part is conſtituted by pure lime (g).

(e) Though the tartareous acid, according to Bergman and others, has leſs affinity with alkalis than the mineral acids, yet it decompoſes in part ſulphate, nitrate, and muriate of kali; and ſeparates ſuch a portion of their baſe as is required to convert it into the ſtate of tartareous acidule, or cream of tartar. And as it does not produce the ſame effect on nitrate and muriate of ſoda, it has been advantageouſly employed as an adequate teſt to diſcover the ſpecies of fixed alkali combined with the muriatic acid in medicated waters.

On the inſoluble parts, which remained after boiling, was poured ſome diſtilled vinegar, and the mixture frequently ſhaken; this being filtrated, and the clear ſolution evaporated to dryneſs, a white filamentous ſubſtance was procured, which, on expoſure to the air for ſome time, ſlightly deliqueſced. Hence the preſence of magneſia is clearly pointed out; for, as Bergman has remarked, acetite of lime is permanent in a moiſt air, but deliqueſcent, if any portion of acetite of magneſia be united with it. In order to aſcertain the reſpective proportions of theſe two earths, I made uſe of diluted ſulphuric acid, ſo that ſulphate of lime and ſulphate of magneſia were formed. Theſe two compounds, on account of the difference between them in ſolubility, I obtained ſeparate without much trouble, and by evaporation determined the quantity of each. Thus with calculation the proportion of lime and magneſia was made determinable, knowing that 100 parts of ſulphate of lime, when well dried, contain 42 of earth, and that 36 parts of earth are contained in a centenary of ſulphate of magneſia when perfectly dry (h).

(f) Phyſical and Chemical Eſſays, vol. I. p. 32.

(g) Ibid. p. 180.

What remained undiſſolved after the affuſion of diſtilled vinegar was ſubjected to the action of muriatic acid, which diſſolved the whole, excepting two grains. With the argillaceous earth, therefore, it appears that a ſmall portion of ſiliceous was united.

(h) Ibid. p. 180.

Principles obtained by Diſtillation.

Having thus determined both the nature and quantity of the fixed principles contained in this water, it was next neceſſary to inquire alſo into its aërial contents; ſince of the different mineral waters to be met with in this and other countries, it is now well known to every one at all converſant in their chemical as well as medical qualities, that the more celebrated owe their principal virtues to the aëriform fluids diſſolved in them. Having provided myſelf therefore with a pneumatic machine, holding exactly half a gallon, wine meaſure, and conſtructed agreeably to the directions given by my ingenious friend Dr. Garnett, of Harrogate *(i)*, I filled it at the well, and immediately placed a graduated phial of rain water, heated to about 100°, over the tube. The whole apparatus was then put on the fire, and the water made to boil gently, during which numerous bubbles of air were extricated and aroſe into the inverted phial. The quantity of permanently elaſtic fluid collected in this way,

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(i) New London Medical Journal, vol. I. p. 233.

after making the neceſſary allowance for rarefaction by heat, amounted to 6½ cubic inches. This fluid, on being agitated with lime water, immediately occaſioned a milky turbidneſs, and at the ſame time imparted to it a ſlight ſulphureous ſmell. The whole of it was alſo quickly abſorbed, excepting two cubic inches, which, notwithſtanding long continued agitation, remained undiminiſhed, and which inſtantly extinguiſhed a lighted wax taper upon its being immerſed in them. From theſe circumſtances, I was immediately led to conclude, that this water contains azote, ſulphurated hydrogen, and carbonic acid; but in what proportions it remained yet to determine.

Fourcroy, in his analyſis of the waters of Enghïen, near Montmorency, has recommended litharge to abſorb ſulphurated hydrogen in the cold *(k)*. I therefore filled at the well two full-ſized quart bottles, into each of which two ounces of litharge had been previouſly put; theſe I carefully corked and agitated, in order that the ſulphurated hydrogen gas might the more effectually be attracted by the litharge. After ſtanding

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(k) Elements of Chemiſtry, tranſlated by Nicholſon, vol 3. p. 496.

about ten days inverted in water, the bottles were then opened, and the water contained in them, which had entirely loſt its peculiar fetid ſmell, being poured into the pneumatic machine, it was cauſed to boil in the manner as formerly deſcribed. The quantity of gas obtained from the half-gallon of water after this treatment, was 4½ cubic inches; two of which, as in the preceding experiment, were not abſorbable by water, and inſtantly extinguiſhed a lighted wax taper when immerſed in them. From this experiment, together with the former, it appeared that, in every gallon of this water, wine meaſure, there are contained at leaſt five cubic inches of carbonic acid gas, or fixed air, four cubic inches of ſulphurated hydrogen gas, or hepatic air, and a like quantity of azotic gas, or phlogiſticated air.

In collecting the above permanently elaſtic fluids, however, I could not but entertain a ſuſpicion that, as water, tho' heated to 100°, made a principal part of the means employed, their quantity muſt have been ſomewhat diminiſhed, in conſequence of ſome remaining aptitude or diſpoſition in the water, to abſorb them while paſſing thro' it. In order,

therefore,

therefore, to ſatisfy myſelf with reſpect to this matter, the two following experiments were carefully made. 1. Thro' a column of rain water, near ſeven inches in height, and equal to that employed in the preceding experiments, at the temperature of 100° of Farenheit's thermometer, ſix cubic inches of carbonic acid gas were paſſed gradually, bubble by bubble, from the mouth of a common four ounce phial; the quantity of gas remaining after this proceſs, on making the neceſſary deduction for its increaſed rarefaction from the heat of the water and containing phial, was five cubic inches nearly.—— 2. Of three cubic inches of ſulphurated hydrogen gas, which were next paſſed from a common two ounce phial, through an equal height of rain water heated to 100°, and in the ſame gradual manner as in the laſt experiment, one cubic inch and half only remained unabſorbed, on the requiſite allowance being made for the air's increaſed rarefaction ariſing from the additional heat communicated to it. Theſe experiments not only prove the conſiderable effect of water, though heated to 100°, in abſorbing ſulphurated hydrogen and carbonic acid gas; but alſo point out the reſpective quantities of each liable to be abſorbed, under circumſtances ſimilar to thoſe here deſcribed.

It will, I imagine, be readily perceived that, in tranſmitting thoſe permanently elaſtic fluids very gradually thro' water, I imitated as nearly as I could the appearances which occur during the ſeparation of them from a mineral-water: And this I did, in order that a proper eſtimate might be formed of the quantity to be allowed for abſorption, in the trials made on the Nottington water as above mentioned. The abſorption of ſulphurated hydrogen gas appears very conſiderable, being one half of the whole quantity ſubjected to experiment; and tho' the loſs of carbonic acid was by no means in equal proportion, yet it is ſufficiently great to deſerve notice in inquiries of this nature, where all poſſible accuracy ought ſeduloufly to be obſerved.

Upon the whole, I apprehend, it may be fairly concluded, that a wine gallon of this water contains 16 cubic inches of aëriform fluid; of which three parts in four conſiſt equally of ſulphurated hydrogen and carbonic acid gas, while the remainder is conſtituted of azotic gas, or phlogiſticated air.

From the foregoing analyſis, then, I conclude, that in a ſingle gallon of Nottington water, wine meaſure, the ſubſequent principles are contained, and in the following proportions:

	Grains.
Muriate of kali, or ſal digeſtivus Sylvii,	$10\frac{1}{2}$
Carbonate of kali,	$4\frac{1}{2}$
Sulphate of lime,	4
Carbonate of lime,	7
Carbonate of magneſia,	3
Alumine,	3
Siliceous earth,	1

	Cubic Inches.
Azotic gas, or phlogiſticated air,	4
Carbonic acid gas, or fixed air,	6
Sulphurated hydrogen gas, or hepatic air,	6

BEFORE proceeding further in this inquiry, I think it neceſſary to introduce a few obſervations on the methods recommended to be employed, with a view to ſeparate, and thence to aſcertain, the reſpective quantities of ſulphurated hydrogen and carbonic acid gas when preſent in a mineral water; ſince they will ſerve, in a great meaſure, to ſhow my reaſons for adopting the foregoing method in the preſent analyſis. Dr. Garnett, to whom the public is indebted for a valuable treatiſe on the waters of Harrogate, has propoſed the uſe of lime for that purpoſe *(l)*; from a perſuaſion that this ſubſtance will abſorb and retain the carbonic acid, and leave only the ſulphurated hydrogen gas to be extricated, together with the azotic gas which may exiſt at the ſame time. It is evident that, allowing lime exerts no further action on the exiſtent gaſes than is here ſuppoſed, it would prove a very proper and convenient inſtrument for accompliſhing the neceſſary ſeparation of them. But from a variety of judicious experiments lately inſtituted, it would ſeem, that this opinion is not well founded; for, according to theſe experiments, lime, as well as alkalies both fixed and volatile, poſſeſſes a ſtrong diſpoſition to abſorb ſulphurated hydrogen gas when falling within its ſphere of attraction *(m)*. How far indeed its power of attracting this aëriform fluid may be diminiſhed by the preſence of carbonic acid in the water examined, experiments alone can ſufficiently determine; if, however, we may in-

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(l) New London Medical Journal, vol. 1. p. 245.

(m) Journal de Phyſique, tom. 40. p. 409, &c.

ſer any thing from analogy in this caſe, it would teach us, that the effect of the acid, as now ſuggeſted, is ſomewhat conſiderable. —When heat is applied to ſulphures made with aërated alkalies, a portion of ſulphurated hydrogen is diſengaged, along with carbonic acid gas; but, in order to procure any extrication of air from cauſtic ſulphures, an acid is required, which in conſequence of its greater affinity ſeizes the alkali, and by ſaturating this, gives occaſion to the hepatic gas to eſcape, heat of itſelf being totally inſufficient for that purpoſe. That carbonic acid, therefore, diminiſhes the affinity of lime for ſulphurated hydrogen, there is ſtrong reaſon to conclude; yet lime I preſume can never be employed with advantage in ſeparating thoſe aëriform fluids, for reaſons which the experienced chemiſt, on a little reflection, cannot but readily perceive.

The ingenious authors of the experiments above alluded to, finding that the permanently elaſtic fluid obtained from ſulphures made with aërated potaſh, ſoda, &c. contained carbonic acid gas, by its extinguiſhing light and precipitating lime water, were deſirous of diſcovering alſo the preſence of ſulphurated

phurated hydrogen. After trying with ammonia and lime water in vain, they had next recourſe to nitrous acid; which they were led to make trial of, from an obſervation of Fourcroy, that it readily decompoſes ſulphurated hydrogen gas. Nor were they, in the employment of this ſubſtance, diſappointed in their expectations; for, as they relate, inſtantly on plunging the mouth of a phial containing gas procured from ſulphure of aërated alkali, into nitrous acid, a diminution of the aëriform fluid took place, and ſulphur was depoſited: the remaining aërial ſpace, on examination, they found to be filled with carbonic acid gas *(n)*.

From the reſult of the experiment as here deſcribed, I was ſtrongly inclined to imagine, that nitrous acid might be employed, not only to detect the preſence of ſulphurated hydrogen when combined with carbonic acid gas, but alſo to determine the exact proportion of each of theſe aëriform fluids. Leſt, however, I ſhould too haſtily adopt as a concluſion, what future experiments might contradict, I reſolved to try the effect of the acid, after the following manner:—Having

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(n) Journal de Phyſique, tom 40. p. 420.

ing procured an ounce phial of ſulphurated hydrogen gas, as pure as poſſible, I plunged it inverted into nitrous acid; upon which a film of ſulphur was immediately depoſited, and yet near three fourths of the original quantity of gas remained. From the ſuppoſed purity of the gas ſubjected to trial, I could by no means be induced to think, that this remaining quantity conſiſted wholly of carbonic acid gas, though it is not improbable but that there was a ſlight admixture of this; but having omitted to examine it ſufficiently, I cannot undertake to ſpecify its nature exactly. The event of the experiment, however, afforded me reaſon to believe, that the expectations I had formed of nitrous acid, with reſpect to the uſe to which it ſeemed applicable, were inſufficiently grounded; and that it was neceſſary, therefore, to deviſe ſome other leſs exceptionable mode of ſeparating the two ſpecies of aëriform fluid before mentioned. What could give riſe to the difference of reſult in this experiment, and that immediately preceding, I muſt confeſs myſelf at preſent unable to determine; ſince it can ſcarcely be accounted for, on the idea of the acid not being duly phlogiſticated, as that, which I made uſe of, exhaled copious reddiſh fumes.

It may perhaps be expected by ſome, that I ſhould attempt to explain in what manner the aërial impregnation of this water is effected. This, indeed, might very properly form a part of our inquiry; but, as there is reaſon to ſuſpect that Nature is not always exactly uniform, with regard to the means ſhe employs in hepatiſating waters, I fear ſuch an undertaking, if it were attempted, would carry me beyond the limits propoſed for this eſſay. In omitting this part of our ſubject, therefore, I hope to be excuſed; and more particularly, as whatever I might here be led to advance, would perhaps be conſidered as rendered, in a great meaſure, ſuperfluous by the judicious obſervations of Bergman *(o)*, Dr. Garnett *(p)*, and others; to whoſe valuable works I beg leave to refer ſuch of my readers as may wiſh for an ample inveſtigation of this curious and intricate point.

(o) Phyſ. and Chem. Eſſays, vol. 2. p. 343.

(p) Treat. on the Harrogate Waters, p. 71. See alſo Watſon's Chem. Eſſays, vol. 5. p. 31, and vol. 3. p. 197; Walker's Treat. on Harrogate Water, p. 96; and Aſh's Exper. and Obſer. on the Waters of Spa and Aix-la-Chapelle,

I cannot, however, with equal propriety, omit to offer a few remarks on the co-exiſtence of aërated vegetable alkali and ſelenite, or ſulphate of lime, in this water; which, I truſt, is fully demonſtrated by what has been already related, however irreconcilable it may appear with the known laws of chemical attraction. Bergman mentions, that he has ſometimes met with in Spa water, a ſmall portion of ſelenite, in the quantity of about one grain to a kanne *(q)*; notwithſtanding he has clearly ſhewn, by actual experiment, that it alſo contains 8½ grains of cryſtallized mineral alkali. This he accounts for, by obſerving that ſubſtances which are ſo thinly ſcattered thro' water, may naturally be ſuppoſed to act very ſlowly on each other; and moreover, that the activity of the alkali is greatly repreſſed from its union with carbonic acid. This laſt circumſtance he illuſtrates

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(q) Dr. Cullen, of Dublin, having retained the word kanne, which is a Swediſh meaſure, in his tranſlation of Bergman's Chemical Eſſays, without ſpecifying the quantity it denotes in Engliſh meaſure, I could not well avoid, therefore, employing it here. Whether it is equivalent to 5 ¾ of our wine pints, as is now ſuppoſed, I confeſs I am far from being aſſured; having been, as yet, unable to obtain ſufficient information on that head. This, however, I believe is certain, that the expreſſion does not ſignify a larger quantity; and conſequently, if there be any error, the preſent reaſoning cannot at all be weakened by it, but, on the contrary, will receive additional ſupport.

luſtrates by ſtating the difference of effect, which lime and chalk are capable of exerting on a ſolution of ſulphate of magneſia, or Epſom ſalt:—If to this ſolution, he ſays, a little lime water be added, the magneſia is inſtantly ſeparated from its acid, by the ſuperior attraction of the lime; but if pieces of chalk or calcareous ſpar be thrown into it, no decompoſition can be produced, even by boiling *(r)*.

From theſe obſervations, it is eaſy to underſtand how the vegetable fixed alkali and ſulphate of lime, as contained in Nottington-water, may exiſt together, without any immediate decompoſition. Tho' the quantity of ſelenite diſſolved in this water, is more than double of what Bergman found in Spa water; yet it may be fairly ſuppoſed too inconſiderable to occaſion any material difference, with regard to the particular now under conſideration. Should any one, however, be inclined to expect any perceptible difference, or alteration of appearance, from the ſuperior quantity of ſelenite as above mentioned; he ought at the ſame time to recollect, that the quantity of alkali diſcovered in

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(r) Bergman's Phyſ. and Chem. Eſſays, vol. 1. p. 262.

this water, is much leſs than has been found in Spa water; the latter containing, according to Bergman's analyſis, near three grains to a quart, while the former I have ſhewn to have but one. Any objection, therefore, made to the foregoing explanation of the fact, on account of the additional quantity of ſelenite, it is manifeſt, cannot rightly be maintained; ſince it is clearly counterbalanced by the diſproportion of alkali exiſting in the two waters, as above ſtated.

That the vegetable fixed alkali is ſometimes found, though rarely, in mineral waters, we have ample reaſon to aſſert; however difficult it may be to point out the particular manner in which they become impregnated with it. The authority of Bergman *(s)*, Fourcroy *(t)*, and other eminent chemiſts may be adduced in confirmation of the fact. M. Monnet relates, that he has obtained it, in a ſtate of conſiderable purity, united to the carbonic acid, from ſome of the waters of Spa; and from the experiments made by Dr. Aſh on theſe celebrated waters, we learn the fountains wherein it is preſent.

(s) Phyſ. and Chem. Eſſays, vol. 1. p. 115.

(t) Elements of Chemiſtry, tranſlated by Nicholſon, vol. 3. p. 449.

Theſe are the Sauviniere and Groiſbeeck fountains; they contain it in different proportions, the latter in the quantity of two grains, and the former in that of one grain, to a quart (*u*). That the vegetable alkali is likewiſe to be met with in Nottington water, is a fact which, I apprehend, muſt have appeared ſufficiently obvious from the reſult of the experiments already enumerated. Dr. Aſh obſerves, that it is moſt commonly to be found in mineral waters, combined with the nitric acid; but in the preſent inſtance, no veſtige whatever of this acid could be diſcovered, on the uſual trial being made with volatile alkali. The only acids which this water contains, in combination with the vegetable alkali, we have found to be the muriatic and carbonic.

(*u*) Aſh's Exper. and Obſ. on the Waters of Spa, &c. p. 250.

PART II.

Obſervations on the Virtues and Uſe of Nottington Water in the Cure of Diſeaſes.

THE great efficacy and utility of certain mineral waters denominated ſulphureous, in a variety of complaints incidental to mankind, long experience has abundantly confirmed; but whether the ſanative powers which thoſe waters have been found to poſſeſs, may be more juſtly aſcribed to the ſulphureous principle, than to a ſaline, or any other impregnation aſſociated with it, is a problem which at once cannot righly be reſolved. Experiments have ſhewn, that the ſulphur water at Harrogate contains a large proportion of common ſalt, and that this, aſſiſted by the preſence of other ſaline ſubſtances of a more laxative quality, operates, for the moſt part, very effectually as a purgative on thoſe, who are induced to drink the water in any conſiderable quantity. In many caſes, therefore, there is ſufficient ground for conjecture, that the good effects attending a plentiful uſe of that celebrated water, cannot but be frequently attributable to the evacuation it occaſions; and, accordingly, we find it recommended in diſeaſes which, for their alleviation or removal, are well known to require reiterated purgation, or ſomething ſimilar in effect.

But, altho' its uſefulneſs may more eſpecially depend, in many inſtances, on the evacuant power it poſſeſſes, ſtill there are undoubtedly caſes in which the ſulphureous principle becomes the moſt active and powerful agent; particularly in the cure of moſt inveterate foulneſſes of the ſkin, and a few other diſorders of a widely different nature. As a proof of this, it may not be improper to mention, on the unqueſtionable authority of an ingenious writer, that, in ſome herpetic caſes, very powerful and happy effects have been derived from common water impregnated with hepatic air, employed as a ſubſtitute for the ſulphur water of Harrogate, which had been made uſe of on a former occaſion, with ſucceſs *(a)*. It has been obſerved both of the waters of Harrogate *(b)*, and of Aix-la-Chapelle *(c)*, that they ſometimes tinge ſilver in the pockets of thoſe who drink them regularly for any conſiderable length of time; an effect which ſtrongly evinces the remarkable ſubtilty and pervading nature of the hepatic gas they contain, and how little diſpoſed are the circulating fluids of the body to deſtroy its characteriſtic properties by effecting its decompoſition.

From theſe and like conſiderations, it would ſeem, that in a variety of complaints, eſpecially thoſe of the ſkin, commonly termed ſcorbutic, the moſt happy effects are to be expected from ſulphurated waters, when judiciouſly and properly adminiſtered; and from ſuch waters even as have ſcarcely any ſaline or other active impregnation, excepting that of hepatic air, to which their ſalutary virtues might, with any degree of juſtice, be aſcribed.

How far the Nottington water ſtands entitled to ſerious attention and regard, the

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(a) Garnett's Treatiſe on the Harrogate Waters, p. 111.
(b) Walker's Treatiſe on the Harrogate Water, p. 155.
(c) Lucas on the Waters of Aix-la-Chapelle, &c. p. 148.

foregoing analyſis may enable us to judge with ſome degree of preciſion. For the nature and quantity of the ſubſtances contained in a mineral water, being once diſcovered, there ſurely can be no great difficulty in appreciating its virtues; if but another water of the ſame claſs be at the ſame time fully known to us, the medical and chemical properties of which have been inveſtigated with equal ability and care.

That this water is not ſo ſtrongly impregnated with the ſulphureous principle as Harrogate water, appears clearly from experiments; and conſequently it is not to be expected or ſuppoſed, that its medicinal powers will be found equally ſerviceable in all the ſeveral diſeaſes, to which it is adapted. Still, however, I think myſelf warranted in affirming not only *a priori*, but from actual experience, that, in many inſtances, no inconſiderable benefit may certainly be derived from it, by being judiciouſly and properly applied. As to the difference which may be ſuppoſed to exiſt between them, ſimply on account of its not containing an equal proportion of ſaline ſubſtances, that indeed may be conſidered as of little conſequence; becauſe the ſuperior quantity of any ſaline ſubſtance can be eaſily added to the water at the time of uſing it. This idea has been properly ſuggeſted by Dr. Watſon, Biſhop of Landaff; who obſerves, that any ſtrong ſulphureous water, which naturally contains little or no ſea ſalt, may be rendered ſimilar to Harrogate water, by diſſolving in it a proper proportion of common ſalt *(d)*. According to the experiments of Dr. Garnett, beſides a very large proportion of common ſalt, the Harrogate water contains no inconſiderable quantity of muriated magneſia *(e)*; which ſubſtance therefore ought likewiſe to be joined, whenever it ſhould be judged neceſſary to obſerve accuracy in the imitation.

This water has ſeemingly, with reſpect to its chemical qualities, a very near ſtriking reſemblance to the Moffat water in Scotland *(f)*; and hence it is reaſonable to preſume, that it may be advantageouſly employed in thoſe diſeaſes, for the cure of which that water has been ſo long particularly famed. Poſſeſſed of but a ſmall propor-

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(d) Watſon's Chemical Eſſays, vol. 5. p. 19.

(e) Treatiſe on the Mineral Waters of Harrogate, p. 52.

(f) See Edinburgh Med. Eſſays and Obſ. vol. 1. containing Exper. on the Medicinal Waters of Moffat, by Dr. Plummer.

tion of ſaline bodies, it has been a general practice to drink the Moffat water every day, or every other day, united with a quantity of common, or of Epſom ſalt, ſufficient to produce a laxative effect. Without inquiring into the origin of this practice, there can ſcarce be a doubt, from its having been continued by people of different rank, that additional good effects have not unfrequently been obſerved to have reſulted from it. But as it is no way uncommon, even with phyſiſicians, to have recourſe to a remedy on too many occaſions, which has frequently ſucceeded to their wiſhes, ſo it cannot be wondered, that the cuſtom above-mentioned ſhould be found much too often followed by the ignorant and undiſcerning crowd, or carried to an extent altogether unwarrantable. A late ſurgeon of Moffat, Mr. Milligen, who no doubt had frequent opportunities of ſeeing the bad conſequences ariſing from ſuch general and exorbitant uſe of ſaline purgatives, has expreſſed ſtrongly his diſapprobation of it; but, at the ſame time, he acknowledges, that caſes ſometimes happen, wherein ſuch a practice may be purſued with advantage *(g)*. No one, therefore, ought to enter upon it without ſufficient authority; and as there is often obſervable a material difference in the conſtitutions of different perſons, it can be no leſs manifeſt, that, when followed, it will require to be varied and regulated, according to its effects and the intention of the preſcriber.

Having premiſed theſe few general obſervations, I proceed now to conſider the principal diſeaſes in which the Nottington water promiſes to be of ſervice, pointing out at the ſame time the moſt ſuitable mode of applying it, and where its efficacy may be increaſed with a proper admixture of ſaline ſubſtances.

I before noticed the remarkable effect of ſulphureous waters in thoſe cutaneous diſeaſes, which are commonly, but improperly, termed ſcorbutic, and conſidered how far their efficacy may be attributed to the hepatic gas contained in them. Though the operation of this ſpecies of aëriform fluid in

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(g) See Mr. Milligen's account of the Virtues and Uſe of the Mineral Waters of Moffat, related in the Edinburgh Medical Eſſays and Obſervations, vol. 1.

all impetiginous diſorders is undoubtedly great, yet we are not to imagine it as incapable of increaſe by having a proper proportion of ſaline ſubſtances combined with it; ſince the contrary clearly appears from a compariſon of facts, as well as from an attentive reflection on the nature of thoſe affections. It is from the union of theſe different bodies, that the ſuperior virtue of Harrogate water is chiefly to be accounted for.

Hence thoſe that may be induced to make trial of this water, in hopes of obtaining relief from eruptive complaints, ſhould join with it ſome ſaline body, in order to give it additional effect. What I would recommend, in general, is a compoſition of two parts of common ſalt to one of Epſom, Rochelle, or any other purgative ſalt; and of this ſuch a portion to be taken twice or three times a week, diſſolved in the water, as will render it gently laxative. And on the intermediate days, likewiſe, I cannot but adviſe ſome ſuch ſaline body to be continued, but in leſs quantity, and with a much larger proportion of common ſalt, ſimply with a view to promote perſpiration, and gently ſtimulate the cutaneous veſſels.

As to the quantity of water which it may be proper to drink, no fixed or invariable rule can be given, becauſe that will depend much on the age, ſtrength, conſtitution, and habits of the patient; it may, however, be commonly taken by adults from one pint to three, and upwards, every morning, if nothing forbids, care being at the ſame time obſerved not to overload the ſtomach by drinking too large a quantity at once. When from any circumſtance it ſhould become neceſſary to take it a little warm, I would not adviſe the whole to be heated on the fire, but to add as much of it, boiling hot, to each glaſs at the well, as will be ſufficient to take off the chilneſs, and to drink it immediately afterwards. The propriety of this cannot but readily appear, when it is conſidered how ſoon the aërial principles, on which its virtues more eſpecially depend, are made to eſcape by the application of heat.

It is much to be regretted, that the external application of this water, except in a partial degree, cannot be ſo conveniently conducted as could be wiſhed; ſince nearly equal benefit has been obtained from ſulphureous waters, when employed as a bath, as when taken internally. The Harrogate water, from its having been thought too offenſive, or too dangerous for internal exhibition, was at firſt only uſed as a bath or waſh in diſeaſes of the ſkin, and many of theſe, as is ſaid, were thus happily cured by it *(h)*. Nor can this appear at all incredible to ſuch as conſider thoſe diſeaſes, for the moſt part, as merely local, and as not being connected with any general affection of the ſyſtem, while the appropriate nature of the ſeveral ingredients, which it poſſeſſes, is duly attended to. Even bathing in ſimple warm water, without any further medical means, has been ſometimes attended with ſucceſs; and I believe it is commonly eſteemed of conſequence, in the treatment of ſuch affections, to be able to have recourſe to that remedy, as an auxiliary at leaſt. What ſhare the ſaline impregnation had in the above effect, independent of the ſulphureous principle, is not eaſily aſcertained; though there can be no doubt of its having afforded material aſſiſtance, from the known ſtimulant and detergent quality inherent in common ſalt.

(h) Garnett's Treatiſe on the Waters of Harrogate, p. 115.

As a ſubſtitute, therefore, for this water where a gènerał warm bath is required along with its internal uſe, ſea water may perhaps be employed with advantage. During bathing, which may be repeated every ſecond, third, or fourth day, if nothing ſhould altogether prohibit its uſe, it will be proper for thoſe who are afflicted with a dry ſcaly eruption, to be well rubbed with a fleſh bruſh, or if that ſhould excite too much pain, with a piece of flannel; ſo as ſufficiently to cleanſe and deterge the pores of the ſkin, and thus to render them the more permeable to the perſpirable fluid.

Where the eruption is not very extenſive, but confined to particular parts, perhaps there will be little occaſion for having recourſe to general bathing; ſince whatever good it is capable of producing, may probably be attained with waſhing only the affected parts daily. In all ſuch caſes, therefore, I would recommend the Nottington water, which will admit of being applied topically with ſufficient eaſe, in preference to ſea water, on account of the hepatic air it contains, which ſeems to act ſomewhat as a ſpecific in cutaneous complaints. Previous to its being uſed, however, in that way, it will be adviſable, in general, to make it a little warm in the manner before deſcribed, and to unite with it a greater or leſs proportion of common ſalt, ſo that its power, as a ſtimulant, may be duly augmented.

That this water will be found no leſs beneficial in ſcrophulous diſorders than in thoſe juſt mentioned, is a circumſtance which, however ſtrongly to be wiſhed, is perhaps ſcarcely to be expected. Yet, if we may rely on the accounts that are given us, concerning the virtues of other waters, to which it bears a very near and ſtriking reſemblance, no one can fairly conſider it as deſtitute of power, eſpecially when aided by the uſe of other remedies, to alleviate greatly diſeaſes of that nature, if not frequently to accompliſh the entire removal of them. The Moffat water to which, as I before remarked, it is ſtrongly allied with reſpect to its mineral contents, owes, I believe, much of its celebrity to the many inſtances of ſcrophula diſappearing while under its uſe; and it is even affirmed by Mr. Milligen, that he never once ſaw it fail of curing that diſorder, when continued a ſufficient length of time, excepting where the conſtitution was too much decayed, or where ſymptoms exiſted during which it ought no way to have been employed *(i)*. Mr. Bell has likewiſe given no ſmall teſtimony in its favour; for ſpeaking of ſcrophulous tumors, he obſerves, that the only remedy he has ever experienced to act, with any apparent efficacy, in preventing their ſuppuration, has been a long continued uſe of the cold bath, particularly of ſea-bathing, and of mineral waters, eſpecially thoſe of Moffat *(k)*.

From what is here ſaid, it is obvious, that the Nottington water deſerves at leaſt a candid trial in ſcrophulous complaints; and as the employment of it may be conveniently accompanied with ſea-bathing, there is much ground to hope, that, from the united operation of two ſuch remedies, very material benefit may hereafter be obtained. But, without being regularly and duly perſevered in, it would be abſurd to expect any great or permanent relief from them. In ſpeaking of the uſefulneſs of Moffat water in ſuch caſes, Mr. Milligen obſerves, that a few ſeaſons were commonly neceſſary for compleat-

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(i) Edinburgh Medical Eſſays and Obſervations, vol. 1. p. 69.

(k) Bell's Surgery, vol. 5. p. 510.

ing a cure; and, immediately on the ſmalleſt appearance of ſcrophula ſupervening, Mr. Bell adviſes ſuch a ſituation to be reſorted to as that one or other of the remedies before mentioned can be uſed, with perhaps little interruption, for a number of years. To obtain therefore a full and laſting effect, it is to be ſuppoſed, that a ſingle ſeaſon will ſeldom prove ſufficient, unleſs indeed the internal uſe of this water, together with ſea-bathing, ſhould greatly exceed the expectations one may reaſonably form of it, from a knowledge of the good effects produced by ſuch remedies, when ſeparately employed.

With reſpect to the quantity of water neceſſary to be taken, near the ſame directions may be obſerved as have been before recommended in diſeaſes of the ſkin. I imagine that few caſes will occur, except among very young children, wherein a leſs quantity than a pint ought to be drank daily, at proper intervals; and that ſeldom more than two quarts, if ſo much, will be required by thoſe who have paſſed the age of puberty. It is proper to mention, however, by way of caution, that in diſeaſes of this kind, as well as in all others, this water ſhould be very ſparingly drank while the patient has a cough, or is any way hectically diſpoſed; becauſe, under theſe circumſtances, it ſeldom fails to occaſion an aggravation of ſymptoms, when taken to the uſual amount.

Whether it is likely to derive any additional efficacy from the admixture of any extraneous ſaline body, is ſomewhat uncertain; yet I am inclined to think, that a few grains of the foſſil alkali, with perhaps a ſmall portion of common ſalt, would, in moſt inſtances, make no improper addition. For, not to mention the utility of natural ſaline waters in general, it frequently happens that thoſe, who labour under ſcrophula, are troubled with an acidity of the ſtomach and primæ viæ; which ſymptom probably will be beſt obviated or corrected by ſomething of the above kind.

That an outward application of this water to ſcrophulous ſores would be attended with any advantage ſuperior to what common water is capable of producing, may be juſtly doubted. At Moffat it has long been the practice among perſons ſo affected, either to waſh the ulcers with the ſulphureous water frequently in the day, or, which is preferable,

ble, to keep linen cloths, made wet with it, conſtantly applied to them. Thus, it is ſaid, the ſores are rendered cleaner, the pain accompanying them is alleviated, and their healing, in ſome meaſure, probably promoted. The ſame effects, however, have been likewiſe known to follow the uſe of common water, as appears from an obſervation of the late illuſtrious Dr. Cullen, who mentions, that he has always ſeen it of equal ſervice with any mineral water commonly employed *(l)*. Whenever, therefore, ſuch an application may be deemed requiſite, it will be of little conſequence perhaps what kind of water is choſen; for the good effect probably depends wholly on the cold communicated, which, from its great aſtringent and tonic power, ſeems well fitted to impart ſtrength and vigour to the relaxed veſſels and fibres of the ulcerated part, and thereby to leſſen or remove that painfulneſs ſo frequently attendant on ſcrophulous ſores.

Concerning the utility of ſulphureous waters in paralytic and other affections occaſioned by the deleterious operation of lead,

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(l) Cullen's Practice of Phyſic, vol. 4. p. 381.

phyſicians are all, I believe, nearly agreed *(m)*. Nor has the uſe of ſuch waters been leſs obvious in caſes, likewiſe, where it was known, that mercury had been too freely or injudiciouſly adminiſtered *(n)*. Thoſe complaints, therefore, whoſe origin may be imputed to an imprudent or accidental application of either of thoſe mineral ſubſtances, will probably be found to admit of no inconſiderable relief from this water, when properly employed.

To further its operation in ſuch caſes, it ſhould be taken always warm, and in general to the extent of two or three pints, and upwards, every day, obſerving the neceſſary precaution already given, not to permit its volatile aërial principles to exhale, before it is ſwallowed. As it is not recommended with a view to any purgative effect, but rather to occaſion a greater determination of the fluids to the ſurface of the body, it can be of no ſignification whether the whole quantity is taken, at proper intervals, in the

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(m) "—— And it is more particularly in the palſy and tremblings which commonly remain after the painter's cholic, that this Phyſician (Navier) boaſts of the good effects of liver of ſulphur and gaſeous hepatic waters". Fourcroy's Chemiſtry, vol. 3. p. 215, &c.

(n) Lucas on the Waters of Aix-la-Chapelle, p. 177.

morning, or a part is left for the evening, when a glaſs or two may be drank, if the patient chooſes. For by that time, it is to be preſumed, that the ſtomach will nearly have freed itſelf of any nutritive matter taken in the courſe of the day.

By a ſtrict adherence to this method, material benefit no doubt would ſoon be perceived, and at length probably a cure eſtabliſhed; but in moſt inſtances, particularly thoſe accompanied with any degree of palſy, the ſalutary effects of the water would become much more quickly diſcernible, if ſeconded by an occaſional or frequent uſe of the warm bath; which therefore is alſo to be ſtrenuouſly adviſed in conjunction with it. Could the Nottington water be conveniently made uſe of for that purpoſe, I ſhould certainly recommend it in preference to common water; though a bath conſiſting of the latter may be found perhaps but little inferior in real efficacy.

Though I muſt confeſs I have ſeen no inſtance of the anthelmintic virtue of this water, yet, in a few caſes of worms, it is ſaid to have been advantageouſly employed; and, I doubt not, with the occaſional aid of ſome further remedy, but it may be often uſed in ſuch affections, with perfect ſucceſs. The ſulphur water at Harrogate, Dr. Alexander obſerves, is one of the moſt ſovereign remedies yet diſcovered *(o)*; and without doubt, it will ever be found effective in expelling thoſe troubleſome inhabitants of the human body, with the various volatile and fixed ſubſtances which it at preſent contains. For its vermifuge power cannot properly be aſcribed either to its purgative quality, or to its ſulphureous impregnation; but to a combination of theſe. Hence it appears neceſſary, whenever the Nottington water, which naturally contains little ſaline matter, is employed for the cure of worms, that ſomething purgative ſhould be joined with it, or otherwiſe interpoſed as occaſion may require. As a purgative of the ſaline kind, ſea water will anſwer, for the moſt part, exceedingly well, taken in due quantity, and repeated about twice a week. The water itſelf ſhould be drank daily in ſuch quantity as the age, ſtrength, conſtitution, and other circumſtances of the patient will admit, except on the days of taking the purgative,

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(o) Alexander on the Harrogate Water.

when perhaps its uſe ought to be entirely omitted.

For the removal of that ſpecies of worm, called the aſcarides, or thread worms, it is probable, that repeated injections of the water into the inteſtines will prove much more effectual than drinking it; as they lie commonly low in the rectum, and therefore may be ſuppoſed more liable to be deſtroyed by a method of that ſort, provided due care be taken to prevent any aërial matter in the water from eſcaping, previous to its being uſed. I was once informed by a judicious ſurgeon of Edinburgh, that he had frequently adviſed ſea water to be employed in that way, with remarkable good effect; but what ſucceſs others have experienced from it, and whether it is much in uſe, as an anthelmintic remedy, are circumſtances equally unknown to me.

Beſides the ſeveral diſeaſes in which I have here recommended a trial of this water, from a conviction of its efficacy, it is probable, that many others, if not altogether, would at leaſt, in ſome meaſure, yield to its uſe. In ſpaſmodic pains of the ſtomach, or bowels; in affections of the kidnies ariſing from preſence of ſabulous concretions, or ſmall gravel; and in loſs of appetite and tone of the ſtomach induced by hard drinking, or other habits of intemperance, it promiſes to be of ſervice. Sulphureous waters have been likewiſe uſefully employed in many caſes of rheumatiſm of the chronic kind; but as theſe caſes ſeemed to derive more relief from an external application than from an internal, it is ſcarcely to be preſumed, that this water will ever prove of any uſe in that ſpecies of complaint, until ſome method be taken to remedy the preſent inconvenience, which would attend the employment of it for the purpoſes of bathing.

FINIS.

ERRATA.

Page 8, line 3, for *analyſis* read *analyſes.*

Page 16, line 12, for *a glaſs* read *the glaſs.*

Page 44, line 18, after *very,* read *and near.*

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